Answers:

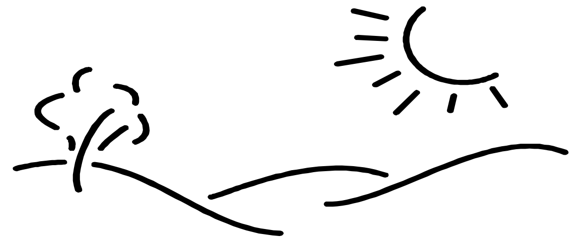
1. True. Most surface water interacts with underground water source. Thus, if groundwater is contaminated, connecting springs, streams, and lakes may suffer the consequences as well.
2. False. Although the soil does filter out many contaminants, it does not protect the groundwater entirely.
3. True. Groundwater moves very slowly through the aquifers at a rate of only inches per day. Some contaminants that reach the groundwater break down slowly or not at all, and move slowly with the water. Therefore, groundwater may contain these contaminants for many years.
4. False. Although business and industry contribute to the problems in the water, municipal, agricultural, and household sources of contamination must be recognized.
5. False. Individuals can alter their lifestyles in some ways to reduce their impact on water use and quality (recycling solid waste, water conservation). The government at all levels has a major responsibility to protect our water supply but it is up to individuals to help solve the problems.
6. False. Many pollutants are odorless, tasteless, and colorless. If any are present, even boiling might not remove them. Testing by a laboratory is the best assurance of quality. State and federal laws require the testing of public water supplies, but testing of private well is up to the homeowner. If your family uses a private well as a source of household water, find out when the most recent test was performed and what the results indicated.
7. True. When many animals are concentrated in an area, such as a livestock yard, animal wastes can be a problem if not properly managed.
8. True. In theory, we can always treat our water to make it drinkable. However, in reality there is a point reached where it can no longer be feasible or affordable to purify our water. Prevention of contamination though careful land use and education the public can protect us from costly treatment.
9. False. Lawn fertilizer may increase the nitrate level in groundwater and rain washes nitrates into the soil.
10. False. Rural areas can have problems of pesticide, fertilizer, and petroleum contamination, as well as problems of water shortages.

Discuss these answers thoroughly with your class

DYE TRACING

Objectives:

Students will define how water can be traced as it moves underground, define parts-per-million and parts-per-billion, and identify two dyes that are commonly used in hydrologic dye traces.



Materials:

- Black light
- Eye dropper
- Sample bottles of rhodamine, flourescein and optical brightener

Procedure:

1. Ask the students to imagine that they have a delicate cave under their land. The cave has several large pools, and water drips from the ceiling in many places. A rare species of blind cave fish lives in several pools in the cave. Two streams run through their property and disappear into the ground in the woods behind their house. The water in one stream is very cloudy and may be polluted. Do the students think the water from the streams is entering the cave? How can they find out?
2. Discuss hyrdrologic dye tracing. Show the students examples of rhodamine and fluorescein, two types of dyes that are often used in dye traces. Stress to the students that the dye is non-toxic and is used in very dilute concentrations.
3. The dye is fluorescent, and often an "optical brightener" (show students the sample bottle) is added to the dye to increase its fluorescence. Optical brightener is found in laundry detergents. It is the ingredient that makes your whites appear whiter and your brights appear brighter, by reflecting sunlight. Turn off the classroom lights and pull down the shades. Turn on the black light and walk around the room holding the brightener near students' clothes, demonstrating to each student that the optical brightener fluoresces. DO NOT SHINE THE BLACKLIGHT IN ANYONE'S EYES!!!!
4. The students are going to use fluorescent dye to trace the streams into the cave. Have them determine how they will tell which stream is providing water to the different pools and drip sites in the cave. (They can put fluorescein in one stream and rhodamine in the other.)
5. How can the dye be detected once it enters the cave? In most cases, the dye will be so dilute that it will be invisible to the naked eye. The pools of water in the cave probably will not turn red or green. Can the fluorescence of the dye help in its detection? Tell the students that a fluorometer can be used to detect very small quantities of fluorescent dye in solution. The dyes will reflect light at different wavelengths, making it possible to detect fluorecein and rhodamine separately.
6. A fluorometer can detect even a few parts-per-billion of rhodamine or fluorecein! What does this mean? Tell the students that if they put a single drop of dye into a 50'x25'x4.5' swimming pool, they have a 1 part-per-billion solution. 3 drops yields a 3 ppb solution. Certain dyes can only be detected in larger concentrations, such as a part-per-million. If you put one drop of dye into a 44-gallon barrel, you have a 1 ppm solution! You may wish to use an eye dropper to illustrate these concentrations.